

TE-215A-4S Modem

Product Description

COLLINS Adaptive Kineplex® Data Communication Modem

The Collins TE-215A-4S uses solid state microminiature construction comprised of plug-in circuit cards and modules utilizing a combination of discrete components, hybrid thin film and integrated circuits. The TE-215A-4S is a full-duplex, four-tone Digital Data Communication Modem capable of 2400 bits per second on UHF radio, as well as other voice channels such as wireline, cable, carrier, or microwave. In addition to the 2400 bit-per-second, 3.33 ms bit length, the TE-215A-4S has a selectable 6.67 ms bit length which provides 1200 bits per second with four tones. Data rates of 1200 BPS or 2400 BPS may be selected from a front panel data rate switch and/or from a remote control which may be located up to 200 feet from the modem.

The Collins TE-215A-4S uses data tones at 935, 1375, 1815 and 2255 cps. These tone frequencies were chosen in the center of the 3-kc frequency band to minimize differential envelope delay distortion and amplitude attenuation near the edges of the passband. The data rates, tone frequencies and audio interfaces are all compatible with TE-207, TE-210, AN/GSC-4 and TE-216 Modems presently in use.



- *Microminiature Construction*
- *1200/2400 Bits Per Second—Voice Bandwidths*
- *Full Duplex*
- *Kineplex Techniques*
- *Designed-In Collins Reliability*



The detection circuits utilize Kineplex kinematic filtering techniques for recovery of the differentially coherent phase-shift keyed data. Each keyed filter in the tone detectors is gated for a period equal to the inverse of the tone spacing to achieve orthogonality with respect to all other tones.

Demodulator synchronization is obtained by an out-of-band sync detection scheme that operates on the composite of the data tones; no special sync tone or modulation is required when operation is with other TE-215 or TE-216 equip-

ment. A squelch circuit is used to inhibit receive timing sync correction when the receive level drops below a predetermined threshold. A frequency standard is used to maintain modem timing stability.

At the serial digital interface, input and output voltage/impedance circuits used conform to MIL-STD-188B. The TE-215A-4S accepts and presents transmit serial timing and presents corrected receive serial timing to peripheral devices.

Specifications

Data Input

Serial, Single channel, synchronous, binary at 1200 or 2400 bits per second

Binary 0 (space) = -0.5 to -20 VDC

Binary 1 (mark) = $+0.5$ to $+20$ VDC

Data rise and fall times: 40 to 80 microseconds

Input Impedance = 5000 ohms or greater

Input Capacitance = 2500 picofarads or less

Data Output

Serial, single channel, synchronous, binary at 1200 or 2400 bits per second

Binary 0 (space) = $-6(\pm 1)$ VDC

Binary 1 (mark) = $+6(\pm 1)$ VDC

Data rise and fall times: 40 microsec. or greater

Output Impedance = 100 ohms or less

Timing Input

Square wave, -0.5 to -20 VDC low level and $+0.5$ to $+20$ VDC upper level

Input Impedance = 5000 ohms or greater

Input Capacitance = 2500 picofarads or less

Input Current = 0.1 ma max. required for operation

Timing Output

Square Wave, $-6(\pm 1)$ VDC low, $+6(\pm 1)$ VDC high

Output Impedance = 100 ohms or less

Timing Oscillator Stability

10^8 parts per day (drift is less than one microsecond per second 30 days following calibration)

Alarms

MODULATOR:

Loss of composite signal output

Loss of data input

DEMULATOR:

Loss of composite signal input

Loss of data output

Power Requirements

103 to 127 VAC, single phase

47 to 420 cps

Audio Input

Level: -35 dbm to $+7$ dbm (input level control provided)

Impedance: 540 to 660 ohms (600 ohms nominal) in freq. range of 300 to 3000 cps

Audio Output

Level: Adjustable -20 dbm to $+5$ dbm (0 dbm nominal)

Impedance: 540 to 660 ohms (600 ohms nominal) in freq. range of 300 to 3000 cps

Function Control

LOCAL:

Power on-off

Data rate switch

Mode selector switch

REMOTE:

Data rate selection

Mode selection

On/off control of transmitted tone composite

Physical Configuration

One-half ATR per ARINC 404 ($7\frac{1}{4}$ H, $4\frac{7}{8}$ W, $19\frac{3}{16}$ L)

27 pounds maximum

Temperature

Operating: -20 to $+71^\circ\text{C}$

Non-operating: -62 to $+85^\circ\text{C}$

Cooling

Ambient temp. air at 16 pounds per hour

Humidity

100% relative humidity with condensation in and on equipment

Altitude

Operating: 0 to 50,000 feet

Shock and Vibration

Per MIL-E-5400G (Dated 15 May 1964) Paragraph 3.2.21.5 and 3.2.21.6.

For additional information write:
Marketing Manager
Collins Radio Company
Newport Beach, California



CREATIVE LEADER IN ELECTRONICS

Outside USA: International Division, Dallas, Texas

TE-215D-4S Modem

Product Description

COLLINS Adaptive Kineplex® Data Communication Modem



- *Microminiature Construction*
- *1200/2400 Bits Per Second—Voice Bandwidths*
- *Full Duplex*
- *Kineplex Techniques*
- *Diversity Receive*
- *Doppler Correction*
- *Designed-In Collins Reliability*

The Collins TE-215D-4S Air-to-Air/Air-to-Ground Kineplex Data Modem is solid state microminiature construction comprised of plug-in circuit cards and modules utilizing a mixed combination of discrete components, hybrid thin film and integrated circuits.

The TE-215D-4S is a full-duplex, diversity with doppler, four-tone Digital Data Communication Modem capable of 2400 bits per second on voice channels such as wireline, cable, carrier, microwave and H.F. radio. In addition to the 2400 bit-per-second, 3.33 ms bit length, the TE-215D-4S has a selectable 6.67 ms bit length which provides 1200 bits per second with four tones. Data rates of 1200 BPS or 2400 BPS may be selected from a front panel data rate switch and/or from a remote control which may be located up to 200 feet from the modem.

The Collins TE-215D-4S uses data tones at 935, 1375, 1815 and 2255 cps. These tone frequencies were chosen in the center of the 3-kc frequency band to minimize differential envelope delay distortion and amplitude attenuation near the edges of the passband. The data rates, tone frequencies and audio interfaces are all compatible with TE-207, TE-210, AN/GSC-4 and TE-216 Modems presently in use.

The detection circuits utilize Kineplex kinematic filtering techniques for recovery of the differentially coherent phase-shift keyed data. Each keyed filter in the tone detectors is gated for a period equal to the inverse of the tone spacing to achieve orthogonality with respect to all other tones.



Demodulator synchronization is obtained by an out-of-band sync detection scheme that operates on the composite of the data tones; no special sync tone or modulation is required when operation is with other TE-215 or TE-216 equipment. A squelch circuit is used to inhibit receive timing sync correction when the receive level drops below a predetermined threshold. A frequency standard is used to maintain modem timing stability.

At the serial digital interface, input and output voltage/impedance circuits used conform to MIL-STD-188B. The TE-215D-4S accepts and presents transmit serial timing

and presents corrected receive serial timing to peripheral devices.

Diversity reception is accomplished by duplicate demodulator circuits for the receive heterodyne, sync error detector and tone detectors. Outputs of the phase detectors of both diversities of a given channel are linearly added before final data recovery in a common detector sampling unit.

Automatic frequency correction for frequency errors up to ± 75 cps due to doppler and radio oscillator drift is obtained by transmitting a C-W doppler tone at 495 cps and using this tone at the receiver to correct the receive-heterodyne injection frequency.

Specifications

Data Input

Serial, Single channel, synchronous, binary at 1200 or 2400 bits per second

Binary 0 (space) = -0.5 to -20 VDC

Binary 1 (mark) = $+0.5$ to $+20$ VDC

Data rise and fall times: 40 to 80 microseconds

Input Impedance = 5000 ohms or greater

Input Capacitance = 2500 picofarads or less

Data Output

Serial, single channel, synchronous, binary at 1200 or 2400 bits per second

Binary 0 (space) = $-6(\pm 1)$ VDC

Binary 1 (mark) = $+6(\pm 1)$ VDC

Data rise and fall times: 40 microsec. or greater

Output Impedance = 100 ohms or less

Timing Input

Square wave, -0.5 to -20 VDC low level and $+0.5$ to $+20$ VDC upper level

Input Impedance = 5000 ohms or greater

Input Capacitance = 2500 picofarads or less

Input Current = 0.1 ma max. required for operation

Timing Output

Square Wave, $-6(\pm 1)$ VDC low, $+6(\pm 1)$ VDC high

Output Impedance = 100 ohms or less

Timing Oscillator Stability

10^8 parts per day (drift is less than one microsecond per second 30 days following calibration)

Alarms

MODULATOR:

Loss of composite signal output

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Loss of composite signal input

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Power Requirements

103 to 127 VAC, single phase

47 to 420 cps

Audio Input

Level: -35 dbm to $+7$ dbm (input level control provided)

Impedance: 540 to 660 ohms (600 ohms nominal) in freq. range of 300 to 3000 cps

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Function Control

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Power on-off

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REMOTE:

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Mode selection

On/off control of transmitted tone composite

Physical Configuration

One-half ATR per ARINC 404 ($7\frac{1}{4}$ H, $4\frac{7}{8}$ W, $19\frac{1}{8}$ L)

Weight

27 pounds maximum

Temperature

Operating: -20 to $+71^\circ\text{C}$

Non-operating: -62 to $+85^\circ\text{C}$

Cooling

Ambient temp. air at 16 pounds per hour

Humidity

100% relative humidity with condensation in and on equipment

Altitude

Operating: 0 to 50,000 feet

Shock and Vibration

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For additional information write:
Marketing Manager
Collins Radio Company
Newport Beach, California



CREATIVE LEADER IN ELECTRONICS

Outside USA: International Division, Dallas, Texas



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Collins TE-216 4800/3600/2400 bps Wireline Data Modems Descriptive Specification

Collins TE-216 Data Modems transmit and receive digital data at rates up to 4800 BPS over voice frequency bandwidth telephone circuits (wireline, carrier, cable or microwave). Design flexibility of the modems provides for increased data rates and customer-selected equipment options to fulfill a wide range of data communication system operational requirements.

Solid state design with integrated circuits employed in all digital circuits contributes to the high degree of reliability. Thorough production and test procedures assure this inherent reliability is an integral part of each element. The modem circuitry is on circuit cards and in modules, each easily plugged into the equipment chassis.

The modems are available in three basic configurations: The TE-216A-4D-4800, TE-216A-3D-3600 and TE-216A-2D-2400 (See table for data rates, tones, frequencies, and telephone circuit specifications). All modem chassis are wired identically. The data rate of the TE-216A-3D-3600 can be increased to 4800 BPS and the TE-216A-2D-2400 to 3600 or 4800 BPS by addition of plug-in circuit card modules. The customer-selected equipment options of DC input/output interface, data rate (fixed or variable), data rate timing, timing oscillator, and synchronization time are also accomplished by addition of the card modules. Besides the equipment feature flexibility, this design approach also makes possible an efficient failure diagnosis and a quick system restoration by simple, card module replacement. The card modules are packaged in a drawer designed to fit standard 19-inch racks or cabinets. The drawer is on slides to provide easy access for tests and maintenance purposes. A special external test unit is available as an accessory.

The modem is designed for continuous, unattended operation. Transmission is full duplex (synchronous transmit and receive operation) over a four-wire telephone circuit. The transmit function of the modem accepts serial digital data from an external source (computers, business machines, voice digitizers, telemetry equipment), phase-amplitude modulates the data on the data tones, and applies the data tones to the telephone circuit. The receive function establishes synchronism with the pulse repetition rate of the signal received from the transmitting modem, demodulates and regenerates the data and provides the data in serial form to the associated input/output equipment. The modems em-

Modem	Data Rate BPS	No. of Data Tones	Normal Data Tone Frequencies Hz	Telephone Circuit Specification**
TE-216A-4D-4800	4800	4	1000 1500 2000 2500	Type 3005 (Schedule 4, Type 4C)
	2400*	2	1500 2000	Type 3004 (Schedule 4, Type 4B) or CCITT M89 (GPO Tariff S)
TE-216A-3D-3600	3600	3	1250 1750 2250	Type 3004 (Schedule 4, Type 4B) or CCITT M89 (GPO Tariff S)
	2400*	2	1500 2000	Type 3004 (Schedule 4, Type 4B) or CCITT M89 (GPO Tariff S)
TE-216A-2D-2400	2400	2	1500 2000	Type 3004 (Schedule 4, Type 4B) or CCITT M89 (GPO Tariff S)
	1200*	1	1750	Type 3004 (Schedule 4, Type 4B) or CCITT M89 (GPO Tariff S)

*When equipped with the variable data rate option.

**As defined in Tariff F.C.C. No. 260 or CCITT Recommendation M89.

ploy synchronous Kineplex® signal detection techniques which provide optimum signal-to-noise performance.†

The following customer-optional features and capabilities are available with all TE-216 modems.

DATA RATE OPTIONS

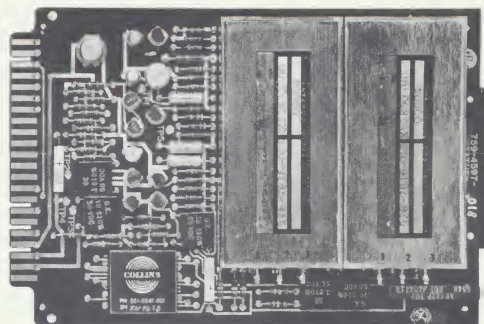
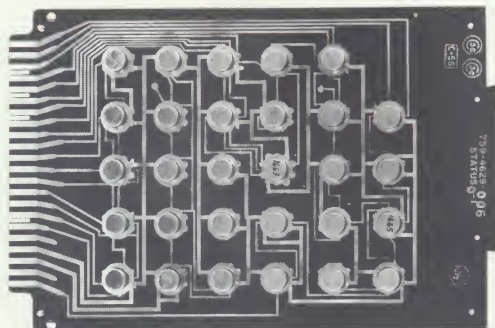
Fixed Data Rate Option provides a single, fixed transmission rate for each modem configuration: TE-216A-4D-4800 is 4800 BPS, TE-216A-3D-3600 is 3600 BPS, and TE-216A-2D-2400 is 2400 BPS.

Variable Data Rate Option provides selectable transmission rates for each modem configuration: TE-216A-4D-4800 is 4800 and 2400 BPS; TE-216A-3D-3600 is 3600 and 2400 BPS; and TE-216A-2D-2400 is 2400 and 1200 BPS.

DC INPUT/OUTPUT INTERFACE OPTIONS

E.I.A. Standard RS-232B Interface Option provides for all data, timing, control and grounding interface circuits between the input/output device and the modem in accordance with the specifications of E.I.A. Standard RS-232B.

†For a detailed analysis of Kineplex techniques, refer to the brochure, "Collins High Speed Data Transmission System, Kineplex."



The modem circuitry is on cards and in modules, each easily plugged into the equipment frame. Shown are a timing card (with integrated circuits) and the sync squelch card (with Collins wideband crystal filters and a Collins thin film flat pack).



CCITT Recommendation V.24 Interface Option provides all data, timing, control and grounding interface circuits between the input/output device and the modem in accordance with CCITT Recommendation V.24.

MIL-Standard-188B Interface Option provides data and timing interface circuits between the input/output device and the modem in accordance with MIL-STD-188B specification.

DATA RATE TIMING OPTIONS

Internal Data Rate Timing Option provides a square wave timing signal to the associated input/output device for timing the input data to the modem. (Modem operation is synchronous. This requires the input data rate be synchronous with the modem timing rate.)

External Data Rate Timing Option provides acceptance of a timing signal at the input data rate from the associated input/output device by means of internal strapping.

TIMING OSCILLATOR OPTIONS

Normal Stability Timing Oscillator Option provides a signal of one part in 10^4 per day for application to the modem time base from which all timing signals are derived.

High Stability Timing Oscillator Options provides stability of one part in 10^8 per day. A receive synchronization circuitry squelch function is included with this option. This function disables the receiver timing synchronization function in the event of high noise or interruptions on the telephone circuit. During the time of disablement, synchronization of the modem is maintained by the inherent stability of the timing oscillators at both send and receive locations.

External Timing Oscillator Input Option provides for the acceptance of an external timing oscillator signal of 100

KHz. The receive synchronization squelch function is also included with this option.

SYNCHRONIZATION TIME OPTIONS

Normal Synchronization Time Option provides synchronism within three seconds following the presence of received carrier at the input to the modem.

Fast Synchronization Time Option provides synchronism within 50 milliseconds following presence of received carrier at the input to the modem. When equipped with this option, the modem also requires the control functions of the RS-232B Interface.

ACCESSORY EQUIPMENT

The Collins TE-890 Test Unit is designed to check the TE-216 Modem performance. The portable unit attaches to one of the modem handles and plugs into the front panel. The



Collins portable TE-890 Test Unit attaches to modem handle to check modem performance.

unit is used to verify the operational status of a local modem and a data link including the modem at each end. The unit also provides the additional capability of independently testing each data tone sub-channel as an aid to isolate a malfunction.

SUPPORT

Collins Radio Company offers full support capability for customer convenience including installation, field engineering, training, and repair depot facilities.

Specifications

AUDIO INPUT/OUTPUT

Frequencies: See table inside.

Levels: Composite Transmit Signal Output: adjustable +4 to -10 DBM. Composite Receive Signal Input: accepts +5 to -30 DBM.

Impedance: 600 ohms ± 10 per cent, 300 to 3200 Hz.

E.I.A. STANDARD RS-232B DATA INPUT/OUTPUT

Send Data Levels: MARK (1) -3v to -20v; SPACE (0) +3v to +20v.

Received Data Levels: MARK (1) -6v ± 1 v; SPACE (0) +6v ± 1 v.

Send Data Input Impedance: Greater than 3000 ohms. Shunt capacity to signal ground measured at the interface and including up to 50 feet of cable shall not exceed 2500 picofarads.

Received Data Output Load Impedance: 3000 ohms or greater.

CCITT RECOMMENDATION V.24 INPUT/OUTPUT

Same as E.I.A. Standard RS-232B and in accordance with CCITT Recommendation V.24.

MIL-STD-188B DATA INPUT/OUTPUT

Send Data Levels: MARK (1) +0.5v to +20v; SPACE (0) -0.5v to -20v.

Received Data Levels: MARK (1) +6v ± 1 v; SPACE (0) -6v ± 1 v.

Send Data Input Impedance: 5000 ohms minimum.

Received Data Output Load Impedance: 5000 ohms minimum.

HIGH STABILITY TIMING OSCILLATOR OPTION

Stability: 1 part in 10^8 per day.

External Frequency Output: 100 KHz.

Source Impedance: 200 ohms nominal.

Signal Level: Bipolar ± 6 v ± 1 v.

MODEM EXPERIENCE

Collins Radio Company is the world's most experienced data communicator. Since the Company's research efforts in the field of synchronous radio teletype nearly 20 years ago, Collins has sold modems for use in surface and air-borne radio and wireline data systems. Collins modems are in service in many industrial systems, at all the United States missile ranges, and in the major data communication systems of all branches of the military services at installations throughout the world.

EXTERNAL TIMING OSCILLATOR INPUT OPTION

Recommended Stability: 1 part in 10^8 per day or better. Frequency: 100 KHz.

Signal Level: 1v to 10v RMS sine wave or square wave.

SYNCHRONIZATION TIME OPTIONS

Normal synchronization: within three seconds.

Fast synchronization: within 50 milliseconds.

OPERATING DUTY CYCLE

Continuous, unattended.

SIZE AND WEIGHT

Designed as drawer mount to fit standard 19-inch racks or cabinets. Height: $8\frac{3}{4}$ inches, Depth $22\frac{1}{2}$ inches, Width $17\frac{1}{2}$ inches. Total weight is 72 pounds.

CONTROLS AND INDICATORS

Operating Control: Power ON/OFF Switch.

Indicator: Power ON lamp.

POWER REQUIREMENTS

105-125 VAC, 210-250 VAC, 47-63 CPS, 300 watts.

ENVIRONMENTAL CONDITIONS

Temperature: Operating +0°C to +50°C; non-operating -55°C to 75°C.

Altitude: Operating, sea level to 10,000 feet; non-operating, sea level to 50,000 feet.

Humidity: Operating, 0 to 80 per cent relative without condensation; non-operating, 0 to 100 per cent.

LINE FACILITY REQUIREMENT

See table inside.

Direct Communications to
Data Equipment Sales
Collins Radio Company
Newport Beach, California 92663
Phone (714) 833-0600

COMMUNICATION / COMPUTATION / CONTROL

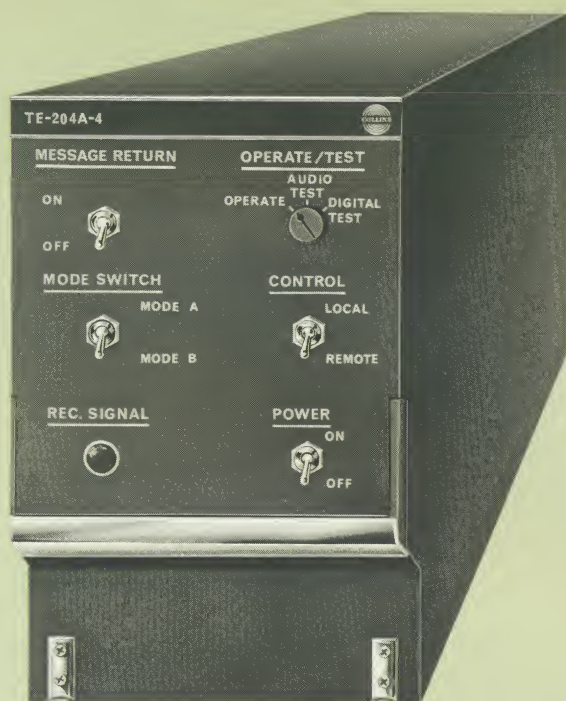


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PRODUCT DESCRIPTION AND APPLICATION

COLLINS TE-204A-4 DATA MODEM



General Description

Collins TE-204A-4 Data Modem, through in-band frequency diversity and time diversity, provides highly reliable data communication. Used primarily in air-ground-air communication networks, the modem transmits and receives synchronous, serial, binary data over a standard 3-kc voice channel derived on SSB, FM, AM or wireline.

Transmitting at 75 bits-per-second, equivalent to 100 words-per-minute, the TE-204A-4 is particularly well suited for teletypewriter, remote control, telephone signaling and many other applications.

The modem provides continuous, unattended, full-duplex service. No adjustments during operation are necessary. Any bit-synchronous coding scheme can be used, for unlike ordinary FSK modems, the TE-204A-4 synchronizes on the transmitted signal, not on the content of the message. Either the built-in or an externally supplied clock pulse can be used for synchronization.

Collins patented Predicted Wave Signaling and kinematic filtering improve the signal-to-noise ratio and reliability. Micro-miniaturized solid-state modules and plug-in, etched-wire circuit cards assure low power consumption, long life, and simple maintenance. Test points are located at the front of the $\frac{1}{2}$ ATR case for easy access.

An internal time base generator provides square-wave bit timing signals for receive and transmit data. Teletype interfacing and control is accomplished internally for associated data transmission and teletype equipment on a full-duplex basis.

Switches on the front panel of the TE-204A-4 (see photo) provide control of signal and power functions.

The TE-204A-4 uses frequency shift keying to convert binary data into four audio tones spaced 440 cycles apart in a frequency range of 935 to 2255 cps.

The synchronization detector selects one of the low frequencies and one of the high frequencies for synchronization of receiver time base to received signal. The modem provides 150 or 600 ohms outputs, enabling it to selectively operate with diverse equipment.

Specifications

Type of Service: Full duplex

Number of Channels: Single channel

Number of Tones: Four tones

Tone Gating Rate: 150 cps

Tone Frequencies:

Mark 1,	935 cps
Mark 2,	1815 cps
Space 1,	1375 cps
Space 2,	2255 cps

Tone Duration: 6.667 ms

Bit Duration: 13.333 ms

Data Rate: 75 bps

Ancillary Interface:

DATA INPUT:

Binary One, +6v
Binary Zero, 0v
Impedance, 5000 ohms

DATA OUTPUT:

Binary One, +6v
Binary Zero, 0v
Impedance, 1800 ohms

TIMING LEVELS:

High Level, +6v
Low Level, -6v

TTY INTERFACE: 5 ma or 60 ma TTY loops. Voltage input (low level interface per MIL-188B)

Audio Input:

Time division multiplex FSK signal variable from 0.25 vrms to 4.0 vrms at 150 ohms, balanced, or 0.5 vrms to 8.0 vrms at 600 ohms, balanced.

Audio Output:

Time division multiplex FSK signal variable from 0.5 vrms to 2.0 vrms at 150 ohms, balanced, or 1.0 vrms to 4.0 vrms at 600 ohms, balanced.

Timing Oscillator Stability:

10^s parts per day

Function Control:

Enable, line to signal ground
Disable, line open

Power Consumption:

55 watts maximum
115 vac + 5% -10%
50 to 400 cycles ±5%
single phase

Physical Configuration:

Standard 1/2 ATR case, 7-5/8" high, 4-7/8" wide, 19-9/16" long

Weight: 23 pounds

Temperature:

Operating, -20°C to +55°C
Non-operating, -62°C to +70°C

Humidity:

80% relative over temperature range without condensation

Altitude:

Operating, 0 to 50,000 feet

Vibration:

On isolated plenum, ARINC category "0",
0.080" da to 10 cps
0.42 g to 15 cps
0.036" da to 65 cps
8 g to 500 cps

Communication Facility Requirements:

FREQUENCY RESPONSE: (Referenced to 1000 cps) 600 cps to 2600 cps, ±1.5 db; 300 cps to 2900 cps, ±3 db; 1000 cps below carrier to 4200 cps, 60 db.

DIFFERENTIAL DELAY: 600 cps to 2600 cps, 1.5 msec; 300 cps to 2900 cps, 3.0 msec.

AUDIO INPUT: 0.5 vrms to 2.0 vrms at 150 ohms or 1.0 vrms to 4.0 vrms at 600 ohms for full rated output.

AUDIO OUTPUT: 0.25 vrms to 4.0 vrms at 150 ohms or 0.5 vrms to 8.0 vrms at 600 ohms.

FREQUENCY STABILITY: ±1 part per million per day; ±30 cps audio output.

AUDIO DISTORTION: 5% maximum.

RF DISTORTION: All intermodulation products 35 db down from either of two equal test tones at full power output.

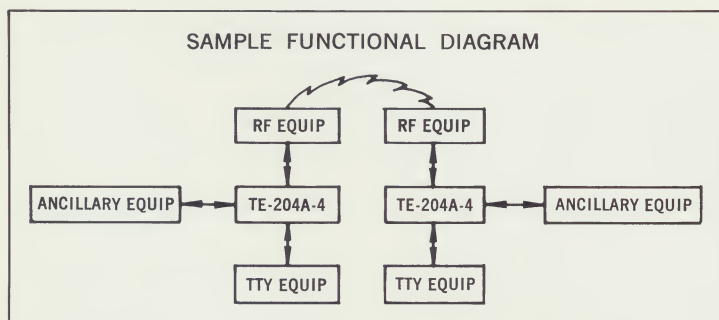
NOISE FIGURE (RECEIVER): 10 db or better.

NOISE OUTPUT (TRANSMITTER): 40 db or better.

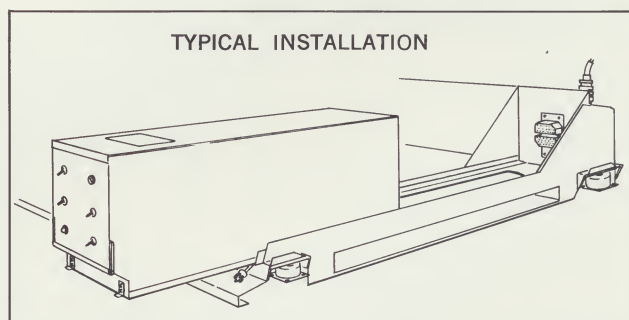
AUTOMATIC GAIN CONTROL: Medium attack and release time constants, less than 500 msec, greater than 50 msec.

TRANSMITTER GAIN CONTROL: Manual with limit set 3 db above full rated output.

SAMPLE FUNCTIONAL DIAGRAM



TYPICAL INSTALLATION



For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

COMMUNICATION/COMPUTATION/CONTROL





PRODUCT DESCRIPTION AND APPLICATION

COLLINS TE-215A-4S MODEM



General Description

The Collins TE-215A-4S uses solid state microminiature construction comprised of plug-in circuit cards and modules utilizing a combination of discrete components, hybrid thin film and integrated circuits. The TE-215A-4S is a full-duplex, four-tone Digital Data Communication Modem capable of 2400 bits per second on UHF radio, as well as other voice channels such as wireline, cable, carrier, or microwave. In addition to the 2400 bit-per-second, 3.33 ms bit length, the TE-215A-4S has a selectable 6.67 ms bit length which provides 1200 bits per second with four tones. Data rates of 1200 BPS or 2400 BPS may be selected from a front panel data rate switch and/or from a remote control which may be located up to 200 feet from the modem.

The Collins TE-215A-4S uses data tones at 935, 1375, 1815 and 2255 cps. These tone frequencies were chosen in the center of the 3-kc frequency band to minimize differential envelope delay distortion and amplitude attenuation near the edges of the passband. The data rates, tones frequencies and audio interfaces are all compatible with TE-207, TE-210, AN/GSC-4 and TE-216 Modems presently in use.

- *Microminiature Construction*
- *1200/2400 Bits Per Second — Voice Bandwidths*
- *Full Duplex*
- *Kineplex Techniques*
- *Designed-In Collins Reliability*

Demodulator synchronization is obtained by an out-of-band sync detection scheme that operates on the composite of the data tones; no special sync tone or modulation is required when operation is with other TE-215 or TE-216 equipment. A squelch circuit is used to inhibit receive timing sync correction when the receive-level drops below a predetermined threshold. A frequency standard is used to maintain modem timing stability.

At the serial digital interface, input and output voltage/impedance circuits used conform to MIL-STD-188B. The

TE-215A-4S accepts and presents transmit serial timing and presents corrected receive serial timing to peripheral devices.

The TE-215A-4S was designed in accordance with the following Military Specifications:

MIL-E-5400F dated 15 March 1963
MIL-T-5422E dated 15 November 1962
MIL-I-6181D dated 25 November 1959
MIL-M-26512C dated 13 December 1963
MIL-D-9281
MIL-P-116D dated 4 December 1962

The Military nomenclature for the TE-215A-4S is USC-9 (V)

Specifications

Data Input

Serial, Single channel, synchronous, binary at 1200 or 2400 bits per second
Binary 0 (space) = -0.5 to -20 VDC
Binary 1 (mark) = $+0.5$ to $+20$ VDC
Data rise and fall times: 40 to 80 microseconds
Input Impedance = 500 ohms or greater
Input Capacitance = 2500 picofarads or less

Data Output

Serial, single channel, synchronous, binary at 1200 or 2400 bits per second
Binary 0 (space) = $-6 (\pm 1)$ VDC
Binary 1 (mark) = $+6 (\pm 1)$ VDC
Data rise and fall times: 40 microsec. or greater
Output Impedance = 100 ohms or less

Timing Input

Square wave, -0.5 to -20 VDC low level and $+0.5$ to $+20$ VDC upper level
Input Impedance = 5000 ohms or greater
Input Capacitance = 2500 picofarads or less
Input Current = 0.1 ma max. required for operation

Timing Output

Square Wave, $-6 (\pm 1)$ VDC low, $+6 (\pm 1)$ VDC high
Output Impedance = 100 ohms or less

Timing Oscillator Stability

One part in 10^8 per day

Alarms

MODULATOR:
Loss of composite signal output
Loss of data input
DEMODULATOR:
Loss of composite signal input
Loss of data output

Power Requirements

103 to 127 VAC, single phase
47 to 420 cps, 42 watts nominal

Audio Input

Level: -35 dbm to $+7$ dbm (input level control provided)
Impedance: 540 to 660 ohms (600 ohms nominal) in freq. range of 300 to 3000 cps

Audio Output

Level: Adjustable -20 dbm to $+5$ dbm (0 dbm nominal)
Impedance: 540 to 660 ohms (600 ohms nominal) in freq. range of 300 to 3000 cps

Function Control

LOCAL:
Power on-off
Data rate switch
Mode selector switch
REMOTE:
Data rate selection
Mode selection
On/off control of transmitted tone composite

Physical Configuration

One-half ATR per ARINC 404
($7\frac{1}{4}$ H, $4\frac{7}{8}$ W, $19\frac{1}{8}$ L)
27 pounds maximum

Temperature

Operating: -20 to 71°C
Non-operating: -62 to $+85^\circ\text{C}$

Cooling

Ambient temp. air at 16 pounds per hour

Humidity

100% relative humidity with condensation in and on equipment

Altitude

Operating: 0 to 50,000 feet

Shock and Vibration

Per MIL-E-5400G (Dated 15 May 1964) Paragraph 3.2.21.5 and 3.2.21.6.

.....
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For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

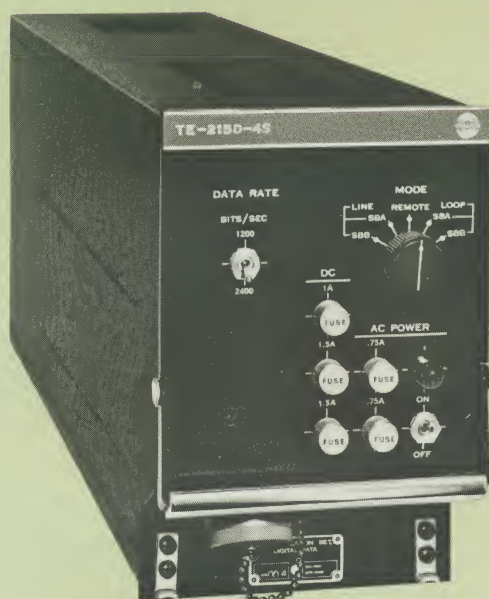
COMMUNICATION/COMPUTATION/CONTROL





PRODUCT DESCRIPTION AND APPLICATION

COLLINS TE-215D-4S MODEM



General Description

The Collins TE-215D-4S Air-to-Air/Air-to-Ground Kineplex[®] Data Modem is solid state microminiature construction comprised of plug-in circuit cards and modules utilizing a mixed combination of discrete components, hybrid thin film and integrated circuits.

The TE-215D-4S is a full-duplex, diversity with doppler, four-tone Digital Data Communication Modem capable of 2400 bits per second on voice channels such as wireline, cable, carrier, microwave and H.F. radio. In addition to the 2400 bit-per-second, 3.33 ms bit length, the TE-215D-4S has a selectable 6.67 ms bit length which provides 1200 bits per second with four tones. Data rates of 1200 BPS or 2400 BPS may be selected from a front panel data rate switch and/or from a remote control which may be located up to 200 feet from the modem.

The Collins TE-215D-4S uses data tones at 935, 1375, 1815 and 2255 cps. These tone frequencies were chosen in the center of the 3-kc frequency band to minimize differential envelope delay distortion and amplitude attenuation near the edges of the passband. The data rates, tone frequencies and audio interfaces are all compatible with TE-207, TE-210, AN/GSC-4 and TE-216 Modems presently in use.

The detection circuits utilize Kineplex kinematic filtering techniques for recovery of the differentially coherent phase-shift keyed data. Each keyed filter in the tone detectors is gated for a period equal to the inverse of the tone spacing to achieve orthogonality with respect to all other tones.

Demodulator synchronization is obtained by an out-of-band sync detection scheme that operates on the composite of the data tones; no special sync tone or modulation is required when operation is with other TE-215 or TE-216 equipment. A squelch circuit is used to inhibit receive timing sync correction when the receive level drops below a predetermined threshold. A frequency standard is used to maintain modem timing stability.

- *Microminiature Construction*
- *1200/2400 Bits Per Second- Voice Bandwidths*
- *Full Duplex*
- *Kineplex Techniques*
- *Diversity Receive*
- *Doppler Correction*
- *Designed-In Collins Reliability*

At the serial digital interface, input and output voltage/impedance circuits used conform to MIL-STD-188B. The TE-215D-4S accepts and presents transmit serial timing and presents corrected receive serial timing to peripheral devices.

Diversity reception is accomplished by duplicate demodulator circuits for the receive heterodyne, sync error detector and tone detectors. Outputs of the phase detectors of

both diversities of a given channel are linearly added before final data recovery in a common detector sampling unit.

Automatic frequency correction for frequency errors up to ± 75 cps due to doppler and radio oscillator drift is obtained by transmitting a C-W doppler tone at 495 cps and using this tone at the receiver to correct the receive-heterodyne injection frequency.

Specifications

Data Input

Serial, single channel, synchronous, binary at 1200 or 2400 bits per second
Binary 0 (space) = -0.5 to -20 VDC
Binary 1 (mark) = $+0.5$ to $+20$ VDC
Data rise and fall times: 40 to 80 microseconds
Input Impedance = 5000 ohms or greater
Input Capacitance = 2500 picofarads or less

Data Output

Serial, single channel, synchronous, binary at 1200 or 2400 bits per second
Binary 0 (space) = $-6(\pm 1)$ VDC
Binary 1 (mark) = $+6(\pm 1)$ VDC
Data rise and fall times: 40 microsec. or greater
Output Impedance = 100 ohms or less

Timing Input

Square wave, -0.5 to -20 VDC low level and $+0.5$ to $+20$ VDC upper level
Input Impedance = 5000 ohms or greater
Input Capacitance = 2500 picofarads or less
Input Current = 0.1 ma max. required for operation

Timing Output

Square Wave, $-6(\pm 1)$ VDC low, $+6(\pm 1)$ VDC high
Output Impedance = 100 ohms or less

Timing Oscillator Stability

10^8 parts per day (drift is less than one microsecond per second 30 days following calibration)

Alarms

MODULATOR:
Loss of composite signal output
Loss of data input
DEMULATOR:
Loss of composite signal input
Loss of data output

Power Requirements

103 to 127 VAC, single phase
47 to 420 cps, 52 watts nominal

Audio Input

Level: -35 dbm to $+7$ dbm (input level control provided)
Impedance: 540 to 660 ohms (600 ohms nominal) in freq. range of 300 to 3000 cps

Audio Output

Level: Adjustable -20 dbm to $+5$ dbm (0 dbm nominal)
Impedance: 540 to 660 ohms (600 ohms nominal) in freq. range of 300 to 3000 cps

Function Control

LOCAL:
Power on-off
Data rate switch
Mode selector switch
REMOTE:
Data rate selection
Mode selection
On/off control of transmitted tone composite

Physical Configuration

One-half ATR per ARINC 404 (7 $\frac{1}{4}$ H, 4 $\frac{7}{8}$ W, 19 $\frac{1}{8}$ L)
27 pounds maximum

Temperature

Operating: -20 to $+71^\circ\text{C}$
Non-operating: -62 to $+85^\circ\text{C}$

Cooling

Ambient temp. air at 16 pounds per hour

Humidity

100% relative humidity with condensation in and on equipment

Altitude

Operating: 0 to 50,000 feet

Shock and Vibration

Per MIL-E-5400G (Dated 15 May 1964) Paragraph 3.2.21.5 and 3.2.21.6.

.....
The TE-215D-4S Modem was designed in accordance with the following military specifications;
MIL-E-5400F dated 15 March 1963
MIL-T-5422E dated 15 November 1962
MIL-I-6181D dated 25 November 1959
MIL-M-26512C dated 13 December 1963
MIL-D-9281
MIL-P-116D dated 4 December 1962
The military nomenclature — for the TE-215D-4S is USC-9 (V).
.....

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TRAINING
DATA COMMUNICATION SEMINARS
MAINTENANCE & OPERATION MANUALS

For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

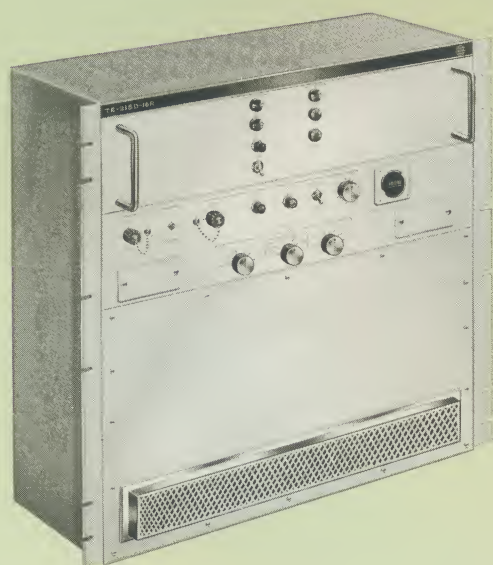
COMMUNICATION/COMPUTATION/CONTROL





PRODUCT DESCRIPTION AND APPLICATION

COLLINS TE-215D-16R HF DATA MODEM



General Description

The TE-215D-16R is a full-duplex, sixteen tone, dual diversity, digital data communication modem capable of transmitting/receiving up to 2400 bps over a HF radio facility. In addition to the 2400 bps rate, the TE-215D-16R has optional data rates of 1200 bps, 1200 bps in-band-diversity, or dual 1200 bps data channels. The data rate modes are selectable from the front panel data rate switch, and/or from a remote control which may be located up to 200 feet from the modem.

The Collins TE-215D-16R HF Kineplex[®] Data Modem uses solid state microminiature construction comprised of plug-in circuit cards and modules which utilize a combination of discrete components, hybrid thin film and integrated circuits.

The TE-215D-16R utilizes 16 subcarrier tones at the following frequencies: 715, 825, 935, 1045, 1155, 1265, 1375, 1485, 1705, 1815, 1925, 2035, 2145, 2255, 2365, and 2475 cps. Each of these subcarrier tones convey two channels of phase coded information.

The TE-215D-16R is capable of either serial or parallel data input/output modes of operation.

Serial Operation

The local and remote serial data rate switches located on the front panel provides the following dc data input/output channels capabilities:

- a) 1 channel—2400 bps
- or b) 2 channels, each 1200 bps
- or c) 1 channel, 1200 bps with in-band diversity

Parallel Operation

The data rate and type of operation are selectable by two plug-in type patch connectors mounted on the modem control panel, any one of 34 parallel input and output options (Fig. 1), or any of nine (9) in-band-diversity (IBD) input and output options (Fig. 2) can be selected by these patch connectors.

- Meets Military Specifications
- Microminiature Construction
- Serial And Parallel Operations
- Selectable Data Rates
- Internal Frequency Standard
(Stability 1 part in 10^8 per day)
- Integral Test Facility

MODE IDENTIFIER		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
NUMBER OF DATA INPUT/OUTPUT CHANNELS	1200 BPS	1	1	1	1	1	1	1	1	1																									
	600 BPS	2	1	1	1						4	3	3	3	2	2	2	2	2	1	1	1	1	1	1	1									
	300 BPS	2	1		4	3	2	1			2	1		4	3	2	1		6	5	4	3	2	1		8	7	6	5	4	3	2	1		
	150 BPS		2	4		2	4	6	8			2	4		2	4	6	8		2	4	6	8	10	12		2	4	6	8	10	12	14	16	

* EXAMPLE:

1 x 1200 BPS Line = 1200 BPS
1 x 600 BPS Line = 600 BPS
4 x 150 BPS Lines = 600 BPS

Total Data = 2400 BPS

* EXAMPLE:

1 x 1200 BPS Line = 1200 BPS
1 x 600 BPS Line = 600 BPS
4 x 150 BPS Lines = 600 BPS
Total Data = 2400 BPS

Figure 1. Parallel Data Input/Output Channel Modes.

MODE IDENTIFIER		1	2	3	4	5	6	7	8	9
NUMBER OF DATA CHANNELS	600	2	1	1	1					
	300	2	1		4	3	2	1		
	150		2	4		2	4	6	8	

*

* EXAMPLE:

1 x 600 BPS Line = 600 BPS
1 x 300 BPS Line = 300 BPS
2 x 150 BPS Lines = 300 BPS
1200 BPS

Figure 2. Parallel DC Data Input/Output Channel Modes with In-Band Diversity.

The TE-215D-16R was designed in accordance with the following Military Specifications:

MIL-E-5400F dated 15 March 1963
MIL-I-6181D dated 25 November 1959
MIL-M-26512C dated 13 December 1963
MIL-D-9281
MIL-P-116D dated 4 December 1962

The Military nomenclature for the TE-215D-16R is USC-10(V)

Specifications

Serial Data Input Per MIL-STD-188B

Serial, Single channel, synchronous, binary at 1200 or 2400 bits per second:
Binary 0 (space) = -0.5 to -20 VDC
Binary 1 (mark) = $+0.5$ to $+20$ VDC
Data rise and fall times: 40 to 80 microseconds
Input Impedance = 5000 ohms or greater
Input Capacitance = 2500 picofarads or less

Serial Data Output Per MIL-STD-188B

Serial, single channel, synchronous, binary at 1200 or 2400 bits per second:
Binary 0 (space) = $-6 (\pm 1)$ VDC
Binary 1 (mark) = $+6 (\pm 1)$ VDC
Data rise and fall times: 40 microsec. or greater
Output Impedance = 100 ohms or less

Serial Timing Input

Square wave, -0.5 to -20 VDC low level and $+0.5$ to $+20$ VDC upper level
Input Impedance = 5000 ohms or greater
Input Capacitance = 2500 picofarads or less
Input Current = 0.1 ma max. required for operation

Serial Timing Output

Square wave, $-6 (\pm 1)$ VDC low, $+6 (\pm 1)$ VDC high
Output Impedance = 100 ohms or less

Parallel Data Input

34 Input and Output Channel Modes (Fig. 1)
9 IBD Channel Modes (Fig. 2)
Binary 0 (space) = $+2.5 (\pm 1.0)$ VDC
Binary 1 (mark) = $0.0 (\pm 0.2)$ VDC
Data Rise and fall times: 40 microsecond
Input Impedance = 1100 ohms or greater
Input Current = .130 ma maximum required for operation

Parallel Data Output

34 channel modes (Fig. 1)
9 IBD channel modes (Fig. 2)
Output Levels: Square Wave;
Binary 0 (space) = $+2.5 (\pm 1)$ VDC
Binary 1 (mark) = $0.0 (\pm .2)$ VDC
Rise and fall times: 40 microseconds

Audio Input

Level: -35 dbm to $+7$ dbm (input level control provided)
Impedance: 540 to 660 ohms (600 ohms nominal) in freq. range of 300 to 3000 cps

Audio Output

Level: Adjustable -20 dbm to $+5$ dbm (0 dbm nominal)
Impedance: 540 to 660 ohms (600 ohms nominal) in freq. range of 300 to 3000 cps

Power Requirements

103 to 127 VAC, single phase
47 to 420 cps, 85 watts

Alarms

Modulator:
Loss of Composite Signal Output
Loss of Data Input
Demodulator:
Loss of Composite Signal Input
Loss of Data Output

Weight

80 lbs.

Temperature

Operating: -20 to $+71^{\circ}\text{C}$
Non Operating: -62 to $+85^{\circ}\text{C}$

Humidity

100% relative humidity with condensations in and on the equipment

Dimensions

Height — 21 inches
Depth — 8 inches
Width — 17 inches

For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

COMMUNICATION/COMPUTATION/CONTROL



WORLD HEADQUARTERS/DALLAS, TEXAS

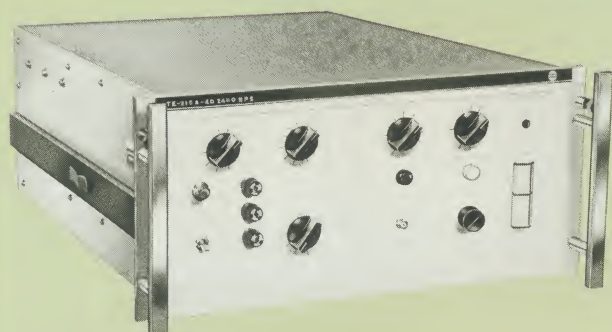
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PRODUCT DESCRIPTION AND APPLICATION

COLLINS TE-216A-4D 2400 BPS MODEM



General Description

The Collins TE-216A-4D (Part No. 522-9919-00) is compatible and electrically interchangeable with the TE-210D-2A Collins data communication modem. The TE-216A-4D offers the same features and flexibility of the TE-210D-2A plus improvements, yet requires less than half the cubic mounting space, weighs less than half as much, and power consumption is reduced more than fifty (50) percent.

The Collins TE-216A-4D is designed for continuous, unattended, automatic, full-duplex operation in any of three switch selected data rate modes; 600, 1200 or 2400 bits per second. Receive and transmit data rates may be different during full-duplex operation. These flexible data rates plus designed-in Collins reliability make the TE-216A-4D Modem the solution to rigorous data transmission applications wherever sustained, accurate performance is required.

The TE-216A-4D is solid state and employs microminiature techniques utilizing integrated circuits and discrete components on circuit cards and in modules. These modems communicate synchronous serial or parallel data between computers, business machines, telemetry equipment, teletype, voice digitizers, and other digital devices.

The TE-216A-4D performs over 3 kc voice bandwidth facilities such as wireline, cable, carrier and microwave having the characteristics specified under FCC Tariff 237, Schedule 4A, maintained in accordance with standard telephone system practices. Phase multiplexing and Collins patented predicted wave detection techniques yield a signal-to-noise ratio four times (6 db) better than frequency shift keyed systems and make optimum use of voice bandwidths.

- 600/1200/2400 Bits per Second
- 4A Voice Bandwidths
- Serial/Parallel Operation
- Full-duplex
- Alarms
- Integral Test Facility
- Phase Delay Compensator
- Compact Construction—
Micromin Techniques

Data Input (Digital)

SERIAL:

Single channel, synchronous, binary at 600, 1200 or 2400 bits-per-second, -1 to +0.25 volts for binary zero and +3.6 to +6.0 volts for binary one, 5000 ohms nominal input impedance.

PARALLEL:

Two, four or eight parallel, 300 bits-per-second, synchronous binary channels, -4.0 to -6.5 volts for binary zero and +1 to -1 volts for binary one, 5000 ohms nominal input impedance.

Data Output (Digital)

SERIAL:

Single channel, synchronous, serial binary at 600, 1200 or 2400 bits-per-second, -1 to +0.25 volts for binary zero and +3.6 to +5.3 volts for binary one, 100 ohms maximum output impedance.

PARALLEL:

Two, four or eight parallel, 300 bits-per-second, synchronous, binary channels, -5.5 to -6.5 volts for binary zero and +0.2 to -0.2 volts for binary one, 100 ohms maximum output impedance.

Audio Input/Output

FREQUENCIES:

600 bits-per-second rate — 1375 cps

1200 bits-per-second rate —

1375 and 1815 cps

2400 bits-per-second rate —

935, 1375, 1815 and 2255 cps

IMPEDANCE:

600 ohms $\pm 20\%$ from 900 to 2300 cps

LEVEL:

Input: Accepts, -35 dbm to +5 dbm.

Output: Variable, -20 dbm to +4 dbm.

DATA RATE TIMING INPUT:

Bipolar square waves, 2.9 to 6.8 volts peak to peak at 600, 1200 or 2400 cps, 5000 ohms nominal.

DATA RATE TIMING OUTPUT:

Bipolar square waves, 3.6 to 5.6 volts peak to peak at 600, 1200 to 2400 cps, 600 ohms maximum.

300 cps and 600 cps input/output: 0 to -6 volts, 10,000 ohms input impedance; 600 ohms output impedance.

Integral Test Facility

Integral Test Facility permits back-to-back testing or systems testing over communication channel. Visual error indication is provided and error indicating pulses are available for an external counter.

Alarms

Loss of receive data (d.c.), transmit level alarm, loss of receive composite signal, and loss of transmit data alarm (d.c.).

Cooling

Internal blowers and distribution — panel controlled air paths maintain suitable internal operating temperatures.

Operating Mode

Full duplex, continuous, unattended at 600, 1200 or 2400 bits-per-second rates.

Timing Output

Derived from an internal 100 kc crystal oscillator, with a frequency stability of 10^{-7} parts per day or better, is provided and may be used to synchronize external equipment.

Timing Input

May be operated from an external 100 kc source with frequency stability of 1×10^{-6} per day, or greater, 5 vrms minimum, 5000 ohms minimum.

Environmental (Operating)

Temperature: $+0^{\circ}\text{C}$ to $+50^{\circ}\text{C}$

Humidity:

0 to 80% relative without condensation

Altitude: 0 to 10,000 feet

VIBRATION: (NON-OPERATING)

Longitudinal plane (front to rear)

5 to 15 cps at .060 DA = 0.7g max
16 to 25 cps at .040 DA = 1.3g max
26 to 33 cps at .020 DA = 1.1g max
34 to 50 cps at .010 DA = 1.3g max
50 cps and above = 1.0g max

Vertical plane

5 to 15 cps at .060 DA = 0.7g max
16 to 25 cps at .020 DA = 0.65g max
26 to 33 cps at .010 DA = 0.55g max
33 cps and above = 0.55g max

Lateral plane (side to side)

5 to 15 cps at .060 DA = 0.7g max
16 to 25 cps at .040 DA = 1.3g max
26 to 33 cps at .020 DA = 1.1g max
34 to 40 cps at .010 DA = 0.82g max
41 cps and above = 0.44g max

Power Requirements

47 - 63 cps, single phase, 105 - 127 VAC or 210 - 250 VAC (tap selectable). 90 watts.

Line Facility Requirement

The TE-216A-4D performs over telephone facilities having the characteristics specified under FCC Tariff 237, Schedule 4A, maintained in accordance with standard telephone systems practices.

Reliability

Greater than 2500 hours mean time between failures (MTBF). Less than 15 minutes average mean time to repair (MTTR). Preventive maintenance average less than 3 hours per month for continuous operation.

Mechanical

One drawer, designed for mounting in rack 19" wide. Drawer size is $8\frac{3}{4}"$ H x $17\frac{1}{2}"$ W x $22\frac{1}{2}"$ D (connector depth). Service is 24 inches minimum, front, for slide out chassis.

Weight

78 Lbs. (approx.)

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For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

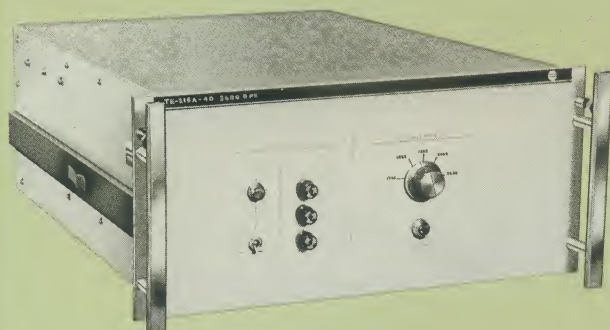
COMMUNICATION/COMPUTATION/CONTROL





PRODUCT DESCRIPTION
AND
APPLICATION

COLLINS TE-216A-4D 3600 BPS MODEM



General Description

The TE-216A-4D CPN 522-9955-00 is a 3600 bps, drawer mounted, four (4) tone Data Communication Modem which utilizes both phase and AM modulation to accept serial binary data and convey this data via audio tones over voice bandwidth (3 KC) wireline, cable, carrier or microwave.

The TE-216A-4D has the following switch selectable data rate modes.

- 1 channel 1200 bps — two tones phase modulated
- 1 channel 1800 bps — three tones phase modulated
- 1 channel 1800 bps — two tones phase & AM modulated
- 1 channel 2400 bps — four tones phase modulated
- 1 channel 3600 bps — four tones phase & AM modulated

The TE-216A-4D has two (2) 1800 bps options for European applications where the transmission facility does not necessarily adhere to Tariff 237 Schedule 4A.

The TE-216A-4D accepts timing information from either an optional 100 KC *integral* frequency standard or an *external* frequency standard input. The integral frequency standard has a stability of 1 part in 10^8 per day. Modems in the same installation may be provided with 100 KC from an integral frequency standard which has been installed in only one (1) modem.

- Kineplex[®] Techniques
- Four Data Rates
 - 1200 bps
 - 1800 bps
 - 2400 bps
 - 3600 bps
- Optional Integral Test Facility
- Optional Frequency Standard (Stability 1 part in 10^8 per day)
- Utilizes Micromin Techniques

An optional portable test facility is designed for operator use from the front of the modem. The portable unit concept permits a single test facility to service a multi-modem installation. The test facility accomplishes back-to-back testing of the modem, or testing with the remote modem over the transmission media.

Theory of Operation

The TE-216A-4D accepts serial binary digital data from computers, business machines, voice digitizers, telemetry equipment, teletype, and other peripheral devices and is compatible with various error protection coding devices. Within the data modem, the binary data is converted to a composite signal consisting of phase and amplitude modulated tones which are applied to a 3 KC bandwidth trans-

mission facility and relayed to a remote data modem. The remote data modem demodulates the individual phase AM modulated tones from the receive composite signal and converts these tones back to binary data. The binary data is then supplied as an output of the receive modem in the order and at the rate that it was given to the transmitting modem. The operation of the data modem is automatic after initial start-up.

Synchronous operation between transmitting and receiving data modems is maintained by a self-correcting time base in the receiving modem that automatically synchronizes with the timing of the transmitting modem. The TE-216A-4D contains a Sync Squelch to disable the synchronization correction circuitry in the event of tone interruption.

Specifications

<i>Data Input/Output:</i>	<i>Data Rate Input & Output Timing</i>	<i>Power Requirements</i>
DATA RATES 1200 bps — 4 ch/2 tones @ 1375, and 1815 cps 1800 bps — 6 ch/3 tones @ 1375, 1815, and 2255 cps 1800 bps — 6 ch/2 tones @ 1375, and 1815 cps plus AM 2400 bps — 8 ch/4 tones @ 935, 1375, 1815, and 2255 cps 3600 bps — 12 ch/4 tones @ 935, 1375, 1815, and 2255 cps plus AM LOGIC LEVELS Binary 0 (space) = -5 to -9 VDC (-8 VDC nominal) Binary 1 (mark) = +5 to +9 VDC (+8 VDC nominal) Input Impedance = 5000 ohms nominal Output Impedance = 100 ohms maximum Data rise and fall times: 40 microseconds or greater	Square Wave, -5 to -9 VDC (-8 VDC nominal) low level and +5 to +9 VDC (+8 VDC nominal) high level peak-to-peak at 1200, 1800, 2400, and 3600 cps Input Impedance: 5000 ohms nominal Output Impedance: 600 ohms maximum Timing Output Internal crystal oscillator: Stability 1 in 10 ⁶ parts/day Square wave +5 to +9 VDC high and -5 to -9 VDC low +8 to -8 VDC nominal) peak-to-peak Impedance is 600 ohms maximum Timing Input (Optional) 100 kc with frequency stability of 1 x 10 ⁶ parts per day, 5 VRMS Impedance = 5000 ohms minimum	105 = 127 VAC or 210 — 250 VAC (Tap selectable) 47 — 63 cps, single phase 90 watts Line Facility Requirements Will perform satisfactorily over telephone facilities having characteristics specified under FCC Tariff 237, Schedule 4A Reliability MTBR: 2500 hours MTTR: 15 minutes Physical Configuration One drawer 8¾" H x 17½" W x 22½" D Designed for mounting in 19" wide racks Collins Radio Company maintains full support capability for customer convenience including the following:
Audio Input/Output Input Level: -35 dbm to +5 dbm Output Level: Adjustable -20 dbm to +4 dbm Impedance: 600 ohms in frequency range 300 — 3400 cps 200 ohms or more at 16 kc Tone Frequencies: 935, 1375, 1815, and 2255 cps Input Filter Characteristics: (rejects 16 kc) 60 db points = 50 cps and 16 kc 1 db points = 200 cps and 5 kc	Alarms Sync inhibited alarm Weight: 78 lbs. Environmental (Operating) Temperature: 0°C to +50°C Humidity: 0 to 80% relative without condensation Altitude: 0 to 10,000 feet	<ul style="list-style-type: none"> • INSTALLATION ASSISTANCE • FIELD ENGINEERING • OVERHAUL & REPAIR DEPOT FACILITIES • SPARES RECOMMENDATIONS • 24-HOUR EMERGENCY SPARE SERVICE • TRAINING • DATA COMMUNICATION SEMINARS • MAINTENANCE & OPERATION MANUALS

For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

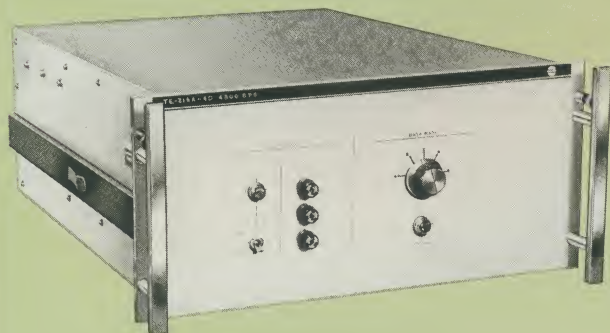
COMMUNICATION/COMPUTATION/CONTROL





PRODUCT DESCRIPTION AND APPLICATION

COLLINS TE-216A-4D 4800 BPS MODEM



General Description

The Collins TE-216A-4D (Part No. 522-9958-00) is a single channel, synchronous, 4800 bps full duplex, drawer mounted Data Communication Modem. The TE-216A-4D accepts serial binary digital data from computers, business machines, voice digitizers, telemetry equipment, teletype and other peripheral devices, and transmits the information over a 3 KC voice bandwidth such as wireline, cable, carrier or microwave. The TE-216A-4D provides channel data rate compatible with various error protection coding devices.

Customer Options

The TE-216A-4D has the following customer options:

1. Variable Data Rate
2. High Stability Frequency Standard
3. Synchronization Squelch
4. Test Facility

Inclusion or omission of an option is a matter of circuit card selection.

In addition to one (1) 4800 bps Serial I/O channel, the variable data rate option provides the following:

SERIAL I/O CHANNELS	MODULATION
2 Channels @ 2400 bps	4 Tones, 4800 bps
4 Channels @ 1200 bps	4 Tones, 4800 bps
1 Channel @ 2400 bps	2 Tones, 2400 bps
2 Channels @ 1200 bps	2 Tones, 2400 bps

The I/O channel modes are switch selectable from the front panel. In addition, external dc control signals may be applied to a connector for remote control of I/O channel mode.

A high stability frequency standard is offered as an option to replace the modem time base when the application demands high stability. This optional frequency standard

- 4800 bps Data Rate
- Internal Frequency Standard: Stability
1 part in 10^8 per day (Optional)
- Optional Test Facility
- Kineplex[®] Techniques
- Five (5) Data Channel Permutations
 - One Channel 4800 bps serial input/output
 - Two Channels 2400 bps serial input/output
 - Four Channels 1200 bps serial input/output
 - One Channel 2400 BPS Series Input/Output
 - Two Channel 1200 BPS Series Input/Output
- Utilizes Microminiature Techniques

has a stability of one (1) part in 10^8 per day and additionally provides a stable 100 KC output for associated devices in a system, or for use with other modems in a multiple installation. The TE-216A-4D can also accept 100 KC stable timing from an external source.

A sync squelch option is available for modems which utilize a high stability frequency standard. Synchronous operation between the transmitting and receiving data modems is maintained by a self-correcting time base in the receiving modem that automatically synchronizes with the timing of the transmitting modem. The sync squelch disables the sync correction circuitry in the event of a line dropout, thus preventing synchronization loss.

An optional portable test facility is designed for operator use from the front of the modem. The portable unit concept permits a single test facility to service a multi-modem

installation. The test facility accomplishes back-to-back testing of the modem, or testing with the remote modem over the transmission media.

Theory of Operation

The TE-216A-4D accepts serial binary digital data from a data source. Within the data modem, the binary data is converted to a composite signal consisting of phase and amplitude modulated tones which are applied to a 3 KC bandwidth transmission facility and relayed to a remote data modem. The remote data modem demodulates the individual phase/AM modulated tones from the receive composite signal and converts these tones to binary data. The binary data is then supplied as an output of the receive modem to the data sink in the order and at the rate that it was given to the transmitting modem. The operation of the data modem is automatic after initial start-up.

Specifications

<p><i>Data Input Per MIL. STD 188B</i></p> <p>Serial, synchronous. Binary 0 (Space) - 0.5 vdc or greater Binary 1 (Mark) + 0.5 vdc or greater Data Rise and Fall Times: 40 micro-seconds</p> <p><i>Data Output Per MIL. STD 188B</i></p> <p>Serial, synchronous. Binary 0 (Space) - 6 (± 6) vdc Binary 1 (Mark) + 6 (± 6) vdc</p> <p><i>Audio Input</i></p> <p>Level: -35 dbm to +5 dbm Impedance: 600 ohms in frequency range 300 to 3400 cps</p> <p><i>Audio Output</i></p> <p>Level: Adjustable -20 dbm to +4 dbm Impedance: 600 ohms in frequency range 300 to 3400 cps</p> <p><i>Tone Frequencies</i></p> <p>1000, 1500, 2000, and 2500 cps</p> <p><i>Operating Duty Cycle</i></p> <p>Continuous, Unattended</p>	<p><i>Visual Displays</i></p> <p>Power-On Indicator Loss of Sync Indicator (Optional)</p> <p><i>Alarms</i></p> <p>Alarm Output MIL-138B Loss of Sync Alarm (Optional)</p> <p><i>Power Requirements</i></p> <p>105 - 125 vac 220 - 250 vac 47 - 63 cps, 90 watts</p> <p><i>Physical Configurations</i></p> <p>Drawer Mounted Height: 8$\frac{3}{4}$" Depth: 22$\frac{1}{2}$" Width: 17$\frac{1}{2}$" Weight: 63# (Designed to fit in standard 19" racks or cabinets)</p> <p><i>Temperature</i></p> <p>Operating: 0°C to +50°C Non-Operating: -55°C to 75°C</p> <p><i>Altitude</i></p> <p>Operating: 0 to 10,000 feet Non Operating: 0 to 50,000 feet</p> <p><i>Humidity</i></p> <p>Operating: 0 to 80% relative without condensation Non Operating: 0 to 100% relative without condensation</p>	<p><i>Line Facility Requirement</i></p> <p>Telephone facilities having the characteristics specified by FCC Tariff 237, Schedule 4B</p> <p><i>Mean-Time-Between-Failure</i></p> <p>Controlled environment: 2500 Hours</p> <p><i>Applicable Military Specifications</i></p> <p>MIL-STD-188B MIL-HDBF-217 MIL-138B</p> <p>Collins Radio Company maintains full support capability for customer convenience including the following:</p> <ul style="list-style-type: none"> • INSTALLATION ASSISTANCE • FIELD ENGINEERING • OVERHAUL & REPAIR DEPOT FACILITIES • SPARES RECOMMENDATIONS • 24 HOUR EMERGENCY SPARE SERVICE • TRAINING • DATA COMMUNICATION SEMINARS • MAINTENANCE & OPERATION MANUALS
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For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

COMMUNICATION/COMPUTATION/CONTROL



WORLD HEADQUARTERS/DALLAS, TEXAS



PRODUCT DESCRIPTION
AND
APPLICATION

COLLINS TE-216D-8D 2400 BPS HF MODEM



General Description

The TE-216D-8D is a 2400 BPS, two drawer, eight (8) tone Data Communication Modem designed to accept serial binary data and convey this data via audio tones over HF radio.

The TE-216D-8D has the following Data Channel Permutations:

One Channel	2400 BPS serial input/output or
Two Channel	1200 BPS serial input/output

The TE-216D-8D has been designed to cover a wide range of *High Frequency Radio* data transmission applications where nominal high frequency (HF) disturbances are expected. The modem operates with 220 cycle tone spacing with a frame period of 6.67 ms.

The TE-216D-8D accepts timing information from either an optional 100 KC integral frequency standard or an external frequency standard input. The integral frequency standard has a stability of 1 part in 10^8 per day. An optional portable test facility is designed for operator use from the front of the modem. The portable unit concept permits a single test facility to service a multi-modem installation. The test facility accomplishes back-to-back testing of the modem, or testing with the remote modem over the transmission media.

Theory of Operation

The TE-216D-8D accepts serial binary digital data from computers, business machines, voice digitizers, telemetry equipment, teletype, and other peripheral devices and is compatible with various error protection coding devices. Within the data modem, the binary data is converted to a composite signal consisting of phase modulated tones which are applied to a 3 KC bandwidth transmission facility and relayed to a remote data modem. The remote data modem demodulates the individual phase modulated tones from the receive composite signal and converts these tones back to binary data. The binary data is then supplied as

- Kineplex[®] Techniques
- Two (2) Data Channel Permutations
 - One Channel 2400 bps serial input/output
 - Two Channel 1200 bps serial input/output
- Optional Integral Test Facility
- Optional Integral Frequency Standard
(Stability 1 part in 10^8 per day)

an output of the receive modem in the order and at the rate it was given to the transmitting modem. The operation of the data modem is automatic after initial start-up.

Synchronous operation between transmitting and receiving data modems is maintained by a self-correcting time

base in the receiving modem that automatically synchronizes with the timing of the transmitting modem. The TE-216D-8D contains a Sync Squelch to disable the sync correction circuitry in the event of tone interruption.

Specifications

Data Input Per MIL-STD-188B

Serial, synchronous, single channel binary @ 2400 BPS, or two channel binary @ 1200 BPS.

Binary 0 (Space) — .5 vdc or greater
Binary 1 (Mark) .5 vdc or greater
Data rise and fall times: 40 microseconds

Data Output Per MIL-STD-188B

Serial, synchronous, single channel binary @ 2400 BPS, or two channel binary @ 1200 BPS.

Binary 0 (Space) — 6 (\pm .6) vdc
Binary 1 (Mark) 6 (\pm .6) vdc

Timing Input/Output:

Per MIL-STD-188B

Audio Input

Level: —35 dbm to 5 dbm
Impedance: 600 ohms in frequency range 300 to 3400 cps

Tone Frequencies

935, 1155, 1375, 1595, 1815, 2035, 2255, 2475 cps

Operating Duty Cycle

Continuous, Unattended

Visual Displays

Power-On Indicator
Loss of Sync Alarm Indicator

Alarms

Loss of Sync Alarm

Frequency Translation Correction (Doppler Unit Option)

Frequency Translation:
(a) +50 cps Doppler Shift
(b) —50 cps Doppler Shift
(c) Doppler Shift cycled linearly from —50 cps to +50 cps to —50 cps @ 2.0 cps/second rate

Power Requirements

105-125 vac or 210-250 vac
47-63 cps, single phase
Power: 118 watts

Physical Characteristics

Two (2) Drawers
Overall size of drawer:
Height: 8 $\frac{3}{4}$ "
Depth: 22 $\frac{1}{2}$ "
Width: 17 $\frac{1}{2}$ "
Designed to fit standard 19" racks or cabinets

Weight:

113 lbs.

Temperature

Operating: 0°C to 50°C
Non-Operating: —55°C to 75°C

Altitude

Operating: 0 to 10,000 feet
Non-Operating: 0 to 50,000 feet

Humidity

Operating: 0 to 80% relative without condensation
Non-Operating: 0 to 100% relative without condensation

Line Facility Requirement

Telephone facilities having the characteristics specified FCC Tariff 237 Schedule 4A

HF Radio Equipment Requirement

Transmitter

Audio Response:
2.5 db 450 to 3050 cps
30 db 4000 cps above carrier
40 db 400 cps below carrier

Differential Delay:
0.5 msec 800 to 3050 cps

0.9 msec 500 to 800 cps
Frequency Stability: 1 part in 10⁸ per day
Frequency Deviation: Not more than 0.5 cps, audio output
Phase Stability: Not more than 4° per bit period
SSB Distortion: At full PEP, all distortion products are 35 db below either tone of a two-tone test signal.
Spurious Signals: At least 50 db below rated PEP
Noise: 40 db below either tone of a two-tone signal.
Audio Input Impedance: 600 ohms
All: Adjustable to more than 90% of PEP

Receiver

Audio Response:
2.5 db 450 to 3050 cps
30 db 4000 cps above carrier
40 db 400 cps below carrier
Differential Delay:
0.5 msec 800 to 3050 cps
0.9 msec 500 to 800 cps
Frequency Stability: 1 part in 10⁸ per day
Frequency Deviation: not more than 0.5 cps, audio output
Phase Stability: not more than 4° per bit period
IM Distortion: 3rd order distortion products per 40 db below either tone of a two tone test signal.
Audio Distortion: Not more than 1% total
Spurious Signals: More than 80 db down including images.
Audio Output: 600 ohms, 8 db max. variation due to AGC control.
AGC: Attach and release time constant of 200 msec.
Gain Stability: Not more than 2 db difference between the audio output levels of the dual diversity receiver.

For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

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TRAINING
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MAINTENANCE & OPERATION MANUALS



PRODUCT DESCRIPTION AND APPLICATION

COLLINS TE-216D-16D 2400 BPS HF MODEM



General Description

The TE-216D-16D is a 2400 BPS, two drawer, full duplex, diversity, sixteen (16) tone, Data Modem designed to accept serial binary data and convey this data via audio tones over HF radio.

The TE-216D-16D Data Modem operates at the following data channel input/output combinations.

One channel 2400 bps serial input/output

Two channel 1200 bps serial input/output

The TE-216D-16D has been specifically designed for high frequency (HF) radio data transmission applications where severe HF disturbances are expected. The modem operates with 110 cycle tone spacing with a frame period of 13.33 ms and an integration period of 9.09 ms.

The TE-216D-16D accepts timing information from either an optional 100 KC *integral* frequency standard or an *external* frequency standard input. The integral frequency standard has a stability of 1 part in 10^8 per day. Modems in the same installation may be provided with 100 KC from an integral frequency standard which has been installed in only one (1) modem.

An optional portable test facility is designed for operator use from the front of the modem. The portable unit concept permits a single test facility to service a multi-modem installation. The test facility accomplishes back-to-back testing of the modem, or testing with the remote modem over the transmission media.

Theory of Operation

The TE-216D-16D accepts serial binary digital data from computers, business machines, voice digitizers, telemetry equipment, teletype, and other peripheral devices and is compatible with various error protection coding devices. Within the data modem, the binary data is converted to a composite signal consisting of phase modulated tones which are applied to a 3 KC bandwidth transmission facil-

- *Kineplex Techniques*
- *Two (2) Data Channel Permutations*
One channel 2400 bps serial input/output
Two channel 1200 bps serial input/output
- *Optional Test Facility*
- *Optional Internal Frequency Standard*
(Stability 1 part in 10^8 per day)
- *Low Error Rate in applications where severe HF Disturbances Exist.*

ity and relayed to a remote data modem. The remote data modem demodulates the individual phase modulated tones from the receive composite signal and converts these back to binary data. The binary data is then supplied as an output of the receive modem in the order and at the rate that it was given to the transmitting modem. The operation of the data modem is automatic after initial start-up.

Synchronous operation between transmitting and receiving data modems is maintained by a self-correcting time base in the receiving modem that automatically synchronizes with the timing of the transmitting modem. The TE-216D-16D contains a Sync Squelch to disable the sync correction circuitry in the event of tone interruption.

Specifications

Data Input Per MIL-STD-188B

Serial, synchronous, single channel binary @ 2400 bps, or two channel binary @ 1200 bps
Binary 0 (space) -0.5 VDC or greater
Binary 1 (mark) +0.5 VDC or greater
Data rise and fall times: 40 microseconds

Data Output Per MIL-STD-188B

Serial, synchronous, single channel binary @ 2400 bps, or two channel binary @ 1200 bps
Binary 0 (space) -6 (± 6) VDC
Binary 1 (mark) +6 (± 6) VDC

Timing Input/Output:

Per MIL-STD-188B

Audio Input

Level: -35 dbm to +5 dbm
Impedance: 600 ohms in frequency range 300 to 3400 cps

Audio Output

Level: Adjustable -20 dbm to +4 dbm
Impedance: 600 ohms in frequency range 300 to 3400 cps

Tone Frequencies

935, 1045, 1155, 1265, 1375, 1485, 1595, 1705, 1815, 1925, 2035, 2145, 2255, 2365, 2475, 2585 cps
Doppler Tone: 495 cps optional

Operating Duty Cycle

Continuous, unattended

Visual Displays

Power on Indicator
Loss of Sync Alarm Indicator

Alarms

Loss of Sync Alarm

Frequency Translation Correction (Doppler option)

Frequency Translation:

Fixed +50 cps Doppler Shift
Fixed -50 cps Doppler Shift
Doppler Shift cycle is linearly from -50 cps to +50 cps to -50 cps at a 2.0 cps/second rate

Power Requirements

105-125 VAC or 210-250 VAC
47-63 cps, single phase
250 watts

Physical Configuration

Two (2) Drawers
Each Drawer:
Height: 8 $\frac{3}{4}$ "
Depth: 22 $\frac{1}{2}$ "
Width: 17 $\frac{1}{2}$ "
Unit is designed to fit in standard 19" racks or cabinets

Weight

126 lbs.

Temperature

Operating: 0°C to +50°C
Non-operating: 55°C to +75°C

Altitude

Operating: 0 to 10,000 feet
Non-operating: 0 to 50,000 feet

Humidity

Operating: 0 to 80% relative without condensations
Non-operating: 0 to 100% relative without condensations

Line Facility Requirement

Telephone facilities having the characteristics specified by FCC Tariff 237 Schedule 4A

HF Radio Equipment Requirement

Transmitter

Audio Response:
2.5 db 450 to 3050 cps

30 db 4000 cps above carrier

40 db 400 cps below carrier

Differential Delay:

0.5 msec 800 to 3050 cps

0.9 msec 500 to 800 cps

Frequency Stability: 1 part in 10⁸ per day

Frequency Deviation: Not more than 0.5 cps, audio output

Phase Stability: Not more than 4° per bit period

SSB Distortion: At full PEP, all distortion products 35db below tone of a two-tone test signal

Spurious Signals: At least 50 db below rated PEP

Noise: 40 db below either tone of a tone-tone test signal

Audio Input Impedance: 600 ohms

ACC: Adjustable to more than 90% of PEP

Receiver

Audio Response:

2.5 db 450 to 3050 cps

30 db 4000 cps above carrier

40 db 400 cps below carrier

Differential Delay:

0.5 msec 800 to 3050 cps

0.9 msec 500 to 800 cps

Frequency Stability: 1 part in 10⁸ per day

Frequency Deviation: Not more than 0.5 cps, audio output

Phase Stability: Not more than 4° per bit period

IM Distortion: 3rd order distortion products are 40 db below either tone of a two tone test signal

Audio Distortion: Not more than 1% total

Spurious Signals: More than 80 db down inclusive images

Audio Output: 600 ohms, 8 db max. variation due to AGC Control

AGC: Attack and release time constant of 200 msec

Gain Stability: Not more than 2 db difference between the audio output levels of the dual diversity receiver.

For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

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DATA COMMUNICATION SEMINARS
MAINTENANCE & OPERATION MANUALS



Newport Beach, California 92663

telephone: area code 714/833-0600

cable: COLINRAD NEWPORT BEACH

THANK YOU

for your interest in our data communication equipment. The literature you requested is enclosed. If you wish to receive more detailed information, please write or call:

Director of Marketing
Collins Radio Company
Post Office Box C
Newport Beach, California 92663

Telephone: (714) 833-0600

TWX: 714-546-0430



PRODUCT DESCRIPTION AND APPLICATION

COLLINS 700B-2 FSK TTY CONVERTER



- *Half-duplex Operation*
- *Single Channel*
- *Teletypewriter Speeds Up to 100 Words per Minute*
- *Standard 2- or 4-wire Teletypewriter Loop*
- *Unattended Operation*
- *ATR Packaging*

GENERAL DESCRIPTION

The 700B-2 is a self-contained, half-duplex FSK TTY converter designed for use in teletypewriter data communication. Two-tone audio frequency-shift keyed (FSK) signals (1575 cps and 2425 cps) are converted to the binary DC levels required to actuate a teletypewriter at speeds to 100 words per minute. The 700B-2 also converts the binary DC output of a teletypewriter to two-tone audio information for transmission in a nominal 3 KC voice channel such as radio or telephone.

The Converter consists of a chassis and four plug-in modules:

Converter, CV-865 URC
Power Supply, PP-2437/URC
Keyer, KY-305/URC
Oscillator, O-655 URC

The converter module changes received audio-frequency information into a binary DC signal that drives the loop-current switch in the keyer module. The power supply module supplies regulated +26-volt DC and unregulated +120-volt DC for the teletypewriter loop. The keyer module contains an electronic switch that controls flow of current in the external teletypewriter loop. The switching action is controlled by the low-level binary DC information from the converter module. The oscillator module is used in the transmit condition to convert binary DC current output information from the teletypewriter to AFSK tones.

THEORY OF OPERATION

A standard 60-ma teletypewriter is controlled by binary DC current flow through the teletypewriter. The two binary current levels are 0 ma and 60 ma. These levels correspond to the SPACE and MARK conditions respectively. Each teletypewriter character is made up of a given combination of marks and spaces.

In the receive mode, an electronic switch in the 700B-2 keyer module controls the flow of teletypewriter loop current. In the transmit mode, loop current switching is controlled by the teletypewriter.

When the audio input frequency is 1575 cps, the keyer switch is open, and current does not flow in the teletypewriter loop. This is the SPACE condition. When the audio input tone is 2425 cps, the keyer switch is closed, and 60 ma current flows through the teletypewriter loop.

In the transmit condition, the keyer switch is closed, and the teletypewriter controls the flow of loop current. In the SPACE condition, no loop current flows. For this condition, the oscillator output frequency is 1575 cps. For a MARK condition, the teletypewriter allows 60 ma of loop current to flow. The oscillator output frequency for the MARK condition is 2425 cps.

SPECIFICATIONS

AUDIO INPUT (RECEIVE):

1575 and 2425 cps, 0.1 to 4.0 volts rms, 600 or 1000 ohms.

AUDIO OUTPUT (TRANSMIT):

1575 and 2425 cps, 15 milliwatts maximum, 600 or 150 ohms.

TELETYPEWRITER:

Standard 60-ma 2- or 4-wire loop.

PRIMARY POWER REQUIREMENTS:

115 volts +5 percent, 400 cps +5 percent, single-phase, 28 watts nominal: +26.5 volts DC \pm 20 percent, 90 ma nominal.

STRAPPING CONNECTIONS:

The 700B-2 may be adapted for operation with a variety of teletypewriter equipment by changing the connection of jumper straps at several locations in the unit and at the rear connector.

ELECTRICAL CONNECTIONS:

All electrical connections to the 700B-2 are made at a 32-pin male connector at the rear of the 700B-2 chassis.

TYPE OF CONSTRUCTION:

Standard short 1/4 ATR chassis with nonpressurized slide-on dust cover. All external connections made through type DPA-32-34P connector on rear panel.

TYPE OF MOUNTING:

Per ARINC 404.

AMBIENT TEMPERATURE RANGE:

-40°C to +50°C.

AMBIENT HUMIDITY RANGE:

Up to 95 percent relative humidity.

ALTITUDE:

Up to 15,000 feet.

SHOCK:

Meets requirements of Munson Road Test.

VIBRATION:

Meets requirements of MIL-STD-167.

SIZE:

2 $\frac{3}{8}$ inches wide, 7 $\frac{9}{16}$ inches high, 15 $\frac{3}{16}$ inches deep.

WEIGHT:

Approximately 9 pounds.

For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

Part Number 523-1000923-001E2J



COMMUNICATION / COMPUTATION / CONTROL

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Collins Radio Company maintains full support capability for customer convenience including:

- INSTALLATION ASSISTANCE
- FIELD ENGINEERING
- OVERHAUL & REPAIR DEPOT FACILITIES
- SPARES RECOMMENDATIONS
- 24 HOUR EMERGENCY SPARE SERVICE
- TRAINING
- DATA COMMUNICATION SEMINARS
- MAINTENANCE & OPERATION MANUALS



PRODUCT DESCRIPTION AND APPLICATION

COLLINS 700B-5 FSK TTY CONVERTER



- *Full-duplex or Half-duplex Operation*
- *Single Channel*
- *Teletypewriter Speeds Up to 100 Words per Minute*
- *Standard 2- or 4-wire Teletypewriter Loop*
- *Unattended Operation*
- *ATR Packaging*

GENERAL DESCRIPTION

The 700B-5 is a self-contained, full-duplex FSK TTY converter designed for use in teletypewriter data communication. Two-tone audio frequency-shift keyed (FSK) signals (1575 cps and 2425 cps) are converted to the binary DC levels required to actuate a teletypewriter at speeds to 100 words per minute. The 700B-5 also converts the binary DC output of a teletypewriter to two-tone audio information for transmission in a nominal 3 KC voice channel such as radio or telephone.

The Converter consists of a chassis and four plug-in modules:

Converter, CV-865 URC
Power Supply, PP-2437/URC
Keyer, KY-305/URC
Oscillator, O-655/URC

The converter module changes received audio-frequency information into a binary DC signal that drives the loop-current switch in the keyer module. The power supply module supplies regulated +26-volt DC and unregulated +120-volt DC for the teletypewriter loop. The keyer module contains an electronic switch that controls flow of current in the external teletypewriter loop. The switching action is controlled by the low-level binary DC information from the converter module. The oscillator module is used in the transmit condition to convert binary DC current output information from the teletypewriter to AFSK tones.

THEORY OF OPERATION

A standard 60-ma teletypewriter is controlled by binary DC current flow through the teletypewriter. The two binary current levels are 0 ma and 60 ma. These levels correspond to the SPACE and MARK conditions respectively. Each teletypewriter character is made up of a given combination of marks and spaces.

In the receive mode, an electronic switch in the 700B-5 keyer module controls the flow of teletypewriter loop current. In the transmit mode, loop current switching is controlled by the teletypewriter.

When the audio input frequency is 1575 cps, the keyer switch is open, and current does not flow in the teletypewriter loop. This is the SPACE condition. When the audio input tone is 2425 cps, the keyer switch is closed, and 60 ma current flows through the teletypewriter loop.

In the transmit condition, the keyer switch is closed, and the teletypewriter controls the flow of loop current. In the SPACE condition, no loop current flows. For this condition, the oscillator output frequency is 1575 cps. For a MARK condition, the teletypewriter allows 60 ma of loop current to flow. The oscillator output frequency for the MARK condition is 2425 cps.

SPECIFICATIONS

AUDIO INPUT (RECEIVE):

1575 and 2425 cps, 0.1 to 4.0 volts rms, 600 or 1000 ohms.

AUDIO OUTPUT (TRANSMIT):

1575 and 2425 cps, 15 milliwatts maximum, 600 or 150 ohms.

TELETYPEWRITER:

Standard 20- or 60-ma, 4-wire loop (Full duplex), or standard 20- or 60-ma, 2-wire loop (Half duplex).

PRIMARY POWER REQUIREMENTS:

115 volts ± 5 percent, 400 cps ± 5 percent, single-phase, 28 watts nominal: ± 26.5 volts DC ± 20 percent, 90 ma nominal.

STRAPPING CONNECTIONS:

The 700B-5 may be adapted for operation with a variety of teletypewriter equipment by changing the connection of jumper straps at several locations in the unit and at the rear connector.

ELECTRICAL CONNECTIONS:

All electrical connections to the 700B-5 are made at a 32-pin male connector at the rear of the 700B-5 chassis.

TYPE OF CONSTRUCTION:

Standard short 1/4 ATR chassis with nonpressurized slide-on dust cover. All external connections made through type DPA-32-34P connector on rear panel.

TYPE OF MOUNTING:

Per ARINC 404.

AMBIENT TEMPERATURE RANGE:

-40°C to $+50^{\circ}\text{C}$.

AMBIENT HUMIDITY RANGE:

Up to 95 percent relative humidity.

ALTITUDE:

Up to 15,000 feet.

SHOCK:

Meets requirements of Munson Road Test.

VIBRATION:

Meets requirements of MIL-STD-167.

SIZE:

$2\frac{3}{8}$ inches wide, $7\frac{9}{16}$ inches high, $15\frac{3}{16}$ inches deep.

WEIGHT:

Approximately 9 pounds.

For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

Part Number 523-1000924-001E2J



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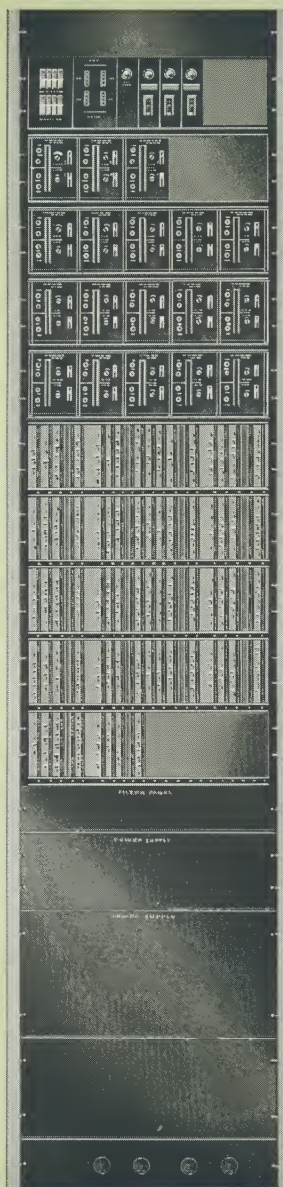
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PRODUCT DESCRIPTION AND APPLICATION

COLLINS TMX-201 DATA AND TELEGRAPH CARRIER *(Transistorized)*

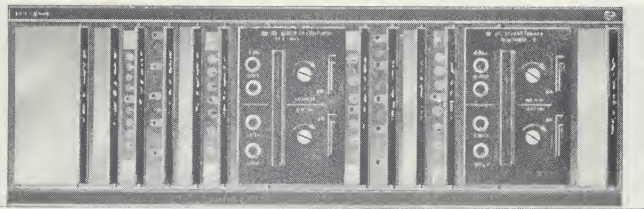


GENERAL DESCRIPTION

The TMX-201 is a transistorized FSK tone multiplex carrier system that converts up to 24 channels of binary data to frequency shift audio tone signals for transmission over a single 4-KC VF channel and reconverts the received tones to the original binary signals. The TMX-201 normally is used for multiplexing data for telegraph, telemetering, remote control, telephone signaling, toll ticketing, TWX, TELEX, and similar applications. Two systems with 120- or 170-cps tone separation are available for Bell or CCITT compatibility, with data speeds of up to 80 bauds with 5 percent maximum distortion. Compact, plug-in circuit card construction eases maintenance and adds flexibility to system applications. Neutral and polar options are available for full-duplex, half-duplex, diversity, hub, TWX, supervisory control and other modes of operation. Various power supply and loop options are available that, together with isolated grounds on loop input and output connections ensure compatibility with standard systems.

FEATURES

Low power consumption—fully transistorized, etched circuit plug-in modules operated well below ratings ensure low power drain and high reliability. • Flexible design — easy and economical expansion of low-density systems. • Isolated ground on input and output loop connections. • Diversity operation available for additional reliability over radio circuits that are subject to selective fading. • Compatible with WECO 43A1 on carrier or dc loop basis. • Transmitter or receiver cards directly interchangeable with all frequency determining elements as separate plug-in cards. • Optional 120- or 170-cps channel spacing — may be intermixed. • No active circuits common to more than one channel except powering. • Quality receive filters assure high adjacent channel rejection and low distortion. • Adjustable carrier deviation for best performance and compatibility with other equipment.



TMX-201 For low density requirements.

SPECIFICATIONS

OPTIONS

Channel Density: Choice of 24 (120-cps spacing) or 18 (170-cps spacing) channels per VF channel.

Receiver Outputs: —10 or —24 v logic; telegraph loops; neutral transistor switch, neutral, polar, polarential, hub, or TWX supervisory that alarms on loss of carrier.

Diversity: For HF applications.

Transmit Keying Inputs: Positive or negative voltage or current loop keying, 20 or 60 ma; high voltage keying 75 to 150 v; low voltage keying 4 to 30 v.

PHYSICAL CHARACTERISTICS

Controls: Transmitter: Output level high and low frequency adjust; Receiver: Threshold and bias adjust; Optional: Loop current controls; composite audio level adjustable by plug-in fixed attenuators.

Test Jacks: Provided on modules with front access at important test points to facilitate maintenance.

Size: 4 duplex channel ends mount in a 5¼-inch card cage requiring 3 vertical spaces on a standard 19-inch rack. 24 channel ends with all powering and loop accessories will mount on an 8-foot rack.

Finish: Rack and Card Cage: Clear chromate; Front Panels and Module Handles: Black anodized.

SERVICE CONDITIONS

Powering: Each transmitter or receiver requires 50 ma maximum at 24 vdc $\pm 10\%$. Carrier equipment

and loop battery supplies are available for 115 vac, 60 cps; 110/220 vac, 50 cps; 48 vdc, or 24 vdc sources. When operating from 24 vdc source, supplies are required only for loop battery.

Ambient Temperature: -10° to $+60^{\circ}\text{C}$

Maximum Relative Humidity: 95% at $+60^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS

Channel Capacity: 1 to 24 per VF channel, or 1 to 18 per VF channel.

Modulation: Frequency Shift.

Multiplexing: Frequency division, 120 or 170 cps spacing.

Transmission Rate: 80 baud (100 wpm), 5% total distortion, maximum; 50 baud (66 wpm) — 5% total distortion, maximum. Higher speeds result in slightly higher distortion.

Frequency Allocation: 420 to 3180 cps in steps of 120 cps or 425 to 3315 cps in steps of 170 cps.

Deviation: ± 30 cps (120-cps channel spacing), ± 42.5 cps adjustable to ± 35 cps (170-cps channel spacing).

Frequency Stability: ± 2 cps over environmental range.

Bias Distortion: 3% maximum change for any 10-db change in the -40 to 0-dbm range at maximum specified transmission rate.

Maximum Transmit Level: 0 dbm/channel (output from filter).

Minimum Receive Level: -40 dbm/channel (input to receive filter).

Transmit Filter Characteristics: 15 db minimum adjacent channel rejection, 600 ohms nominal input and output, unbalanced.

Receive Filter Characteristics: 40 db rejection of adjacent channel — 600-ohm nominal input and output, unbalanced.

For additional information write: Marketing Manager, Collins Radio Company, Newport Beach, California

Part Number 523-1000922-001E2J



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